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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
SMITH, CAROLYN L	
ART UNIT	PAPER NUMBER
1631	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/05/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/061,377	SCHNEIDER ET AL.	
	Examiner	Art Unit	
	Carolyn L. Smith	1631	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 January 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19,40-43,54,55,59-63,80, 81,83-91,93-95 and 98-110* is/are pending in the application.

4a) Of the above claim(s) *3-7,11,12,14,15,19,59-63,80,81,85,90,109 and 110* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,8-10,13,16-18,40-43,54,55,83,84,86-89,91,93-95 and 98-108* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *09/05/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicants' submissions, filed 1/10/06, 9/5/06, and 12/11/06, have been entered.

Amended claims 1-2, 4, 10, 13, 16, 40, 54, 61-62, 90-91, 98, cancelled claims 20-39, 44-53, 56-58, 64-79, 82, 92, 96-97, and new claims 104-110, filed 12/11/06, are acknowledged. Claims 3-7, 11-12, 14-15, 19, 59-63, 80-81, 85, 90, and 109-110 are withdrawn as being drawn to non-elected subject matter.

The information disclosure statement (IDS) submitted on 9/5/06 contains a reference which has already been considered in a previous IDS. Accordingly, the information disclosure statement has been lined through by the examiner.

Claims 1-2, 8-10, 13, 16-18, 40-43, 54-55, 83-84, 86-89, 91, 93-95, and 98-108 are herein under examination.

Claim Rejections - 35 USC § 112, First Paragraph

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 2, 13, 16, 98, and 107 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

NEW MATTER

Claims 2 and 13 recite the interaction between the first "surface" and the second "surface" which appears to be NEW MATTER. While there is written support for interaction between first and second motor proteins (abstract), there is no written support for an interaction between the surfaces which differs in scope. Claim 16 recites "rotatable" wheel that does not appear to have written support in the originally filed disclosure. Because the limitations of the interaction between the first "surface" and the second "surface" and "rotatable" wheel do not appear to have written support in the specification, claims, and/or drawings, as originally filed, these amended limitations are considered to be NEW MATTER.

Claims 98 and 107 are also rejected due to their dependency from claims 2 and 16.

Claim Rejections - 35 USC § 101

NON-STATUTORY SUBJECT MATTER

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 1, 2, 8-10, 13, 16-18, 40-43, 54-55, 83-84, 86-89, 91, 93-95, and 98-108 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The molecular motors as claimed encompass motors within living cells and thus are non-statutory as being directed to a product of nature. While some living cells are statutory, this occurs when the "naturally occurring" subject matter has been distinguished from those changed by the "hands of man".

Applicants argue that neither Oplatka (in the 35 USC 102 rejection) nor Thomas et al. disclose any system in which a first motor molecule is disposed on a first surface and a second motor is disposed on a second surface. It is noted that rotating actin is connected to Z-disks (surface) in nature (Oplatka, page 301, col. 2, first paragraph) and M-line and cross-connections hold thick filaments (myosin) in proper array that represents myosin disposed on a surface (Ganong, page 44, col. 2, last paragraph to page 45, col. 1, first paragraph). It is noted that Thomas et al. and Oplatka describe motors associated with RNA and DNA, including a rotary motor that works its way along the DNA double helix, and other rotary motors *provided by nature*, such as F1-F0 ATPase with a shaft passing through a bearing with rotation experimentally recorded (Thomas et al., page 256, col. 1, first paragraph). It is noted that rotation in actin and microtubule-based motility systems is stated in Oplatka (abstract).

Therefore, the claimed molecular motors in claims 1, 2, 8-10, 13, 16-18, 40-43, 54-55, 83-84, 86-89, 91, 93-95, and 98-108 encompass those motors that are naturally occurring.

Claim Rejections - 35 USC § 112, Second paragraph

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1, 2, 8-10, 13, 17-18, 40-43, 91, 93-95, 104, 107, and 108 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1 (line 5), 104 (line 3), 107 (line 2), and 108 (line 2) recite the limitations "directionally aligned" or "directional alignment" which is vague and indefinite. It is unclear how Applicant intends to define these limitations. Clarification of this issue via clearer claim wording is requested. Claims 2, 8-10, 13, 17-18, 40-43, 91, and 93-95 are also rejected due to their dependency from claim 1.

PRIOR ART

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2, 8-9, 13, 16-18, 40, 43, 83-84, 86-89, 91, 93-95, and 98-108 are rejected under 35 U.S.C. 102(b) as being anticipated by Oplatka [Biochemical and Biophysical Research Communications, Volume 246: 301-306 (1998)] with additional support from Merriam-Webster online dictionary ("array" definition) and Ganong (Review of Medical Physiology, 10th edition, 1981, pages 43-47).

Oplatka disclosess the presence of rotation of an assembly of protein molecules, such as myosin-actin and kinesin (dynein) – microtubules (page 306, col. 1, first paragraph) which represents a molecular rotary motor, as stated in instant claim 1. Oplatka discloses axial rotation of actin filaments sliding over myosin molecules fixed on a glass surface with fluorophores bound to the filaments and actin filaments fixed at their front end (page 302, col. 2, third paragraph) and actin connected to Z-disks (surface) (page 301, col. 2, first paragraph) which represents arrays of both actin and myosin as well as both first and second motor molecules being directionally aligned and disposed on different fixed surfaces, as stated in instant claims 1 and 104. Ganong disclose an M-line and cross-connections that hold thick filaments (myosin) in proper array (page 44, col. 2, last paragraph to page 45, col. 1, first paragraph) which represents myosin disposed on a surface. (It is noted that Ganong is not being used as prior art, but rather to

describe an inherent characteristic of myosin). Oplatka discloses axial protein rotation and data which indicate actin filaments rotate in shortened muscle and microtubules rotate upon interaction with kinesin and dynein (page 306, col. 1, first paragraph and abstract, lines 9-13), which represents close contact to interact and rotate a second array relative to a first array and hence second surface relative to first surface, as stated in instant claims 1 and 16. Oplatka discloses as the thick myosin filaments translate parallel to the actin helix the length of half an actin monomer, the actin helices themselves must each rotate by the angular separation between two vicinal actin monomers (page 301, col. 2, first paragraph) which represents an array of actin (as stated in instant claim 1) and a driven member rotatable in a rotatable direction that substantially parallels the directional alignment of the second motor molecule (as stated in instant claim 107). Merriam-Webster online dictionary define "array" as a group of elements forming a complete unit. Oplatka discloses actin helices rotate about their axis as the thick (myosin) and the thin (actin) filaments interdigitate and the sarcomere contracts (page 301, col. 1, last paragraph), as stated in instant claims 1, 8, and 103. Oplatka discloses axial protein rotation and data which indicate actin filaments rotate in shortened muscle and microtubules rotate upon interaction with kinesin and dynein (abstract), as stated in instant claims 87-89, 94-95, 98, and 101-102. The above-mentioned actin helices represent a driven member, as stated in instant claims 2 and 13. Oplatka discloses the actin are connected to Z-disks (surface) which is a molecular swivel-joint and the actin filament acts as a screw due to rotation (page 301, col. 2, first paragraph) and analogies to a rotating wheel (page 304, col. 2, last paragraph) wherein the disks represent a driven member rotatable wheel as well as a cylindrical surface, as stated in instant claims 16, 83-84, 86, 91, 99-100. Oplatka discloses actin and myosin on fixed surfaces

(page 302, col. 2, third paragraph) with rotating actin connected to Z-disks (page 301, col. 2, first paragraph) which represents the second surface (of myosin) rotatable relative to the cylinder (Z-disk) surface and vice versa, as stated in instant claims 105-108. Oplatka discloses actin filaments fixed to a glass surface and repetitive rotations (page 301, col. 2, second paragraph) which represent at least one complete rotation, as stated in instant claim 93. Oplatka discloses shifts of filaments 5.3 nm toward A bands as well as other lengths including 2.65 nm reminiscent of thin filaments stretched to isometric contraction (page 301, col. 2, last paragraph to page 302, col. 1, first paragraph). Oplatka discloses sliding two sets of filaments 4 nm to diminish isometric force down to zero in quick release experiments (page 302, col. 1, first paragraph) which represents predetermined dimensions to determine power output of the motor, as stated in instant claims 17 and 18. Oplatka discloses shortening sarcomere length from 3.5 mm to 2.05 mm with the sliding distance changing linearly with the change in ATP consumed (page 303, col. 2, foruth paragraph) which also anticipates instant claim 17. Oplatka discloses torque (twisting power) of microtubules that serve as tracks for "motor" proteins (page 302, col. 1, second and third paragraphs). Oplatka discloses actin filaments attached to polystyrene beads (page 302, col. 2, second paragraph). Oplatka discloses actomyosin rotation is coupled with hydrolysis of ATP molecules from interactions generating a mechanical impulse via water jets and operate on water turbines (page 304, col. 2, last paragraph and page 306, col. 1, first paragraph) which represents a propeller mechanism as well as a source of ATP, as stated in instant claims 9, 40 and 43. Oplatka discloses rotation of the myosin head (page 301, col. 2, second paragraph).

Thus, claims 1-2, 8-9, 13, 16-18, 40, 43, 83-84, 86-89, 91, 93-95, and 98-108 are anticipated by Oplatka.

Applicant summarizes instant claim 1. Applicant argues that Oplatka does not describe any system where the first and second motors are disposed on surfaces. This statement is found unpersuasive as Oplatka discloses axial rotation of actin filaments sliding over myosin molecules fixed on a glass surface with fluorophores bound to the filaments and actin filaments fixed at their front end (page 302, col. 2, third paragraph) and actin connected to Z-disks (surface) (page 301, col. 2, first paragraph). Furthermore, Ganong disclose an M-line and cross-connections that hold thick filaments (myosin) in proper array (page 44, col. 2, last paragraph to page 45, col. 1, first paragraph) which represents myosin disposed on a surface. Applicant argues that the motor molecule rotation in Oplatka differs from the instant invention due to distinct differences in the structures of the motor in instant claim 1 and summarizes the axis of rotation in the Oplatka reference, concluding that Oplatka discusses that individual motor molecules rotate, not the surfaces upon which they are disposed. It is noted that the Z-disk surface and cross-connection surfaces on myosin rotate relative to each other since they are connected to actin and myosin, respectively, which rotate. Applicant argues that Oplatka does not disclose a system wherein a second surface rotates relative to a first surface in a rotational direction that substantially parallels the directional alignment of the motor molecule. This statement is found unpersuasive as "directional alignment" has been broadly and reasonably interpreted and Oplatka discloses axial rotation of actin filaments sliding over myosin molecules fixed on a glass surface with fluorophores bound to the filaments (page 302, col. 2, third paragraph) and actin connected to Z-

disks (surface) (page 301, col. 2, first paragraph). Applicant argues that the limitations of instant claims 108 and 110 are not disclosed by Oplatka. It is noted that instant claim 110 was withdrawn due to being drawn to a non-elected species. It is noted that Oplatka discloses actin and myosin on fixed surfaces (page 302, col. 2, third paragraph) with rotating actin connected to Z-disks (page 301, col. 2, first paragraph) which represents the second surface (of myosin) rotatable relative to the cylinder (Z-disk) surface and vice versa. Applicants argue that the axis of rotation described by Oplatka is parallel to the directional alignment of the actin filaments. This statement is found unpersuasive as instant claim 108 which depends from 1 and 91 do not specify if the second motor molecule is actin or myosin. Applicant argues that Oplatka does not teach that Z-discs rotate. This argument is found unpersuasive since Z-discs are attached to actin which rotate. Applicant argues that the motor of instant claim 83 includes a second array of a second motor molecule disposed on a surface and argues that myosin is not disposed on a surface, but rather held in place by slender cross-connections between myosin filaments. This statement is found unpersuasive as slender cross connections represent a surface. Applicant's arguments are deemed unpersuasive for the reasons given above.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 10, 41-42, and 54-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oplatka [Biochemical and Biophysical Research Communications, Volume 246: 301-306 (1998)] as applied to claims 1-2, 8-9, 13, 16-18, 40, 43, 83-84, 86-89, 91, 93-95, and 98-108 in view of Nagai et al. (US 5,499,547) with additional support from Merriam-Webster online dictionary ("array" definition).

Oplatka teaches a molecular rotary motor, as set forth above. Oplatka does not describe a fuel source regulated by a switch or valve (instant claims 41 and 42) or perforation or permeation (instant claims 10, 54, and 55).

Nagai et al. describe actuators using rotatable drive sources such as a fuel engine and biological-organism principle motor which includes coupling the drive source for effecting linear or rotational movement (col. 1, lines 11-23). Nagai et al. state that myosin and actin form a striated muscle (col. 7, lines 41-45). Since muscle cells are cells that are known to comprise perforations, claims 10, 54, and 55 are obviated. Nagai et al. describe supplying and controlling ATP amounts via a valve (col. 8, lines 14-25 and lines 52-55), as stated in instant claims 41-42. Nagai et al. describe fluid biochemical drive sources are united into control drivers used for drive

and power sources such as biological energy (col. 1, lines 23-30). Nagai et al. describe an actuator comprises a solution section, an energy supplying section and an ATP regenerating means as well as myosins and actins (col. 7, lines 18-23). Nagai et al. describe fixing myosin and actin to surfaces (col. 7, lines 21-26). Nagai et al. describe fixing myosin to a movable member (col. 7, lines 34-38). Nagai et al. describe using biomotors and implanting muscle filament and motors to biological materials with cylindrical surfaces, disc shapes, and disc surfaces (col. 6, lines 46-59).

Nagai et al. state coupling the drive source and drive shaft of individual activators cannot be easily performed with high accuracy (col. 1, lines 43-45). Nagai et al. state their invention minimizes the need for adjustment and maintenance of a coupling means as much as possible (col. 1, lines 54-56). Nagai et al. employ actin and myosin motors in their invention as alternatives to the motor and ball screw shaft to drive the table (col. 6, lines 46-50). Oplatka state that no relation has been made to the most fundamental process of ATP hydrolysis by the contractile proteins of actin. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to carry out the ATP generated experiments mentioned by Oplatka with a controlled, highly accurate, power source of ATP, as stated by Nagai et al. (col. 1, lines 5-8). The person of ordinary skill in the art would have been motivated to make this modification because the actuator of Nagai et al. minimizes the need for adjustment and maintenance and improves dynamic and static characteristics of connecting means to convert energy with high efficiency and accuracy (col. 1, lines 43-45 and 54-62).

Thus, Oplatka in view of Nagai et al. make obvious the instant invention.

Applicant again argues that Oplatka does not describe any system where the first and second motors are disposed on surfaces. This statement is found unpersuasive as Oplatka discloses axial rotation of actin filaments sliding over myosin molecules fixed on a glass surface with fluorophores bound to the filaments and actin filaments fixed at their front end (page 302, col. 2, third paragraph) and actin connected to Z-disks (surface) (page 301, col. 2, first paragraph) which represents a rotating actin disposed on a surface. Furthermore, Ganong discloses an M-line and cross-connections that hold thick filaments (myosin) in proper array (page 44, col. 2, last paragraph to page 45, col. 1, first paragraph) which represents myosin disposed on a surface. Applicant argues that Nagai et al. do not compensate for the lack of rotation in Oplatka. This statement is found unpersuasive as both Oplatka and Nagai et al. recite rotation limitations, as described in the rejections above. Applicants argue that Nagai et al. do not describe muscle cells as they exist in nature. This statement is found unpersuasive as Applicants appear to be arguing the 35 USC 101 rejection which is separate from the 35 USC 103 rejection. Applicants argue that striations in muscle cells cannot be equated to perforations in muscle cells. This statement is found unpersuasive as Ganong states tubules that are continuous with the membrane of the muscle fiber form a grid perforated by the individual muscle fibrils (page 45, col. 1, third paragraph). Applicants argue that it is not relevant whether muscle cells include perforations. This statement is found unpersuasive as Nagai et al. state myosin and actin form a striated muscle (col. 7, lines 41-45) wherein muscle cells are cells that are known to comprise perforations. Furthermore, Nagai et al. describe supplying and controlling ATP amounts via a valve (col. 8, lines 14-25 and lines 52-55). Applicants reiterate

arguments regarding motor molecules being disposed on a surface and rotation that have already been found unpersuasive for reasons given above.

Conclusion

No claim is allowed.

Papers related to this application may be submitted to Technical Center 1600 by facsimile transmission. Papers should be faxed to Technical Center 1600 via the PTO Fax Center. The faxing of such papers must conform to the notices published in the Official Gazette, 1096 OG 30 (November 15, 1988), 1156 OG 61 (November 16, 1993), and 1157 OG 94 (December 28, 1993) (See 37 CFR §1.6(d)). The Central Fax Center number for official correspondence is (571) 273-8300.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Carolyn Smith, whose telephone number is (571) 272-0721. The examiner can normally be reached Monday through Thursday from 8 A.M. to 6:30 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Remy Yucel, can be reached on (571) 272-0781.

February 26, 2007

Carolyn Smith
Examiner
AU 1631